3GPP TSG RAN#102 RP-233621

Edinburgh, Scotland, December 11-15, 2023

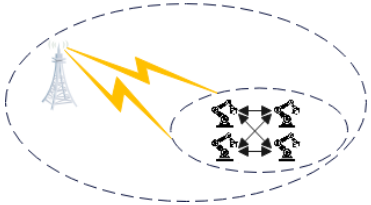
Agenda Item:	**9.1.2.5**
Source:	**ZTE**
Title:	**Views on additional RAN2-led topics in Rel-19**
Document for:	**Discussion and decision**

Topic-1: Views on UE collaboration

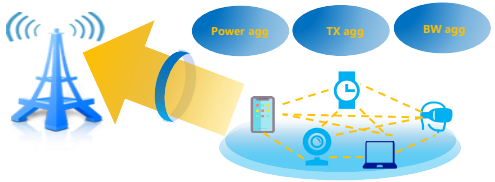
This topic is supported by ZTE, CMCC, Spreadtrum, CEPRI, China Southern Power Grid, CAICT, New H3C, Xiaomi, SGITG

In RP-232182, the following UE aggregation and UE backup scenarios are identified. These scenarios require UE collaboration to improve UL transmission performance in terms of reliability, data rate and power saving etc.

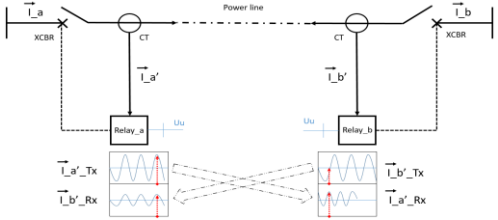
- IIoT scenario
- Personal Area Network scenario
- Metaverse scenario
- Wireless backup in smart grid
- Wireless backup for factory automation
- Wireless backup for remote control of automated Rail-Mounted Gantry (RMG) crane



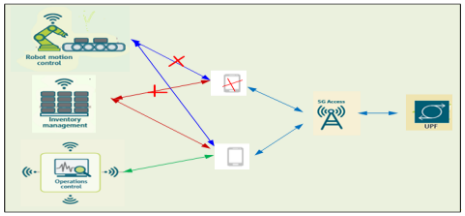
IIoT scenario



Personal Area Network scenario



Wireless backup in smart grid



Wireless backup for factory automation

Topic-1: Views on UE collaboration - Potential solutions

Use Case		Mechanism	Physical Layer Aspect	Gain
Low layer aggregation	**A-1**: Data duplication for high reliability	**Non-transparent scheme via aggregation at MAC layer** • Assistant UE provides complete physical layer functions, including baseband and RF • Non-standardized UE-UE interconnection, e.g., wifi or BT • gNB directly controls assistant UE	• For data duplication, group scheduling of the same TB on same resources (SFN) or different resources	RU reduction: • 49%~55% Mean UPT increase: • DL: 37% • UL: >59%
UE backup	**B-1:** All collaborative UEs are online and backups to each other.	**Non-transparent scheme** • The gNB directly controls all UEs • The data processing at the collaborative UEs is independent	• Simultaneous transmission/reception if no UEs break down • Group scheduling on same resources (SFN) or different resources	RU reduction: 57% UL SNR increase: 3~5 dB
	B-2: One anchor UE + one or more backup UEs.		• Backup UEs transmit/receive only when anchor UE is down • Group scheduling on same resources (SFN) or different resources	

- Note 1: Group scheduling can be applied for A-1, B-1 and B-2 for UL, using similar mechanism as MBS or single DCI multiple TRP scheduling.
- Note 2:
  - ✓ 1) In case of using the same resource, 50% resource reduction compared to PDCP duplication.
  - ✓ 2) The UPT gain comes from dynamic low layer aggregation, including reduced resource utilization, enhanced antenna capability, HARQ combining, better diversity and avoid unnecessary HARQ re-transmission etc.

Topic-1: Views on UE collaboration - Objectives

Objectives

- Specify UE collaboration for UL SFN transmission [RAN1, RAN2]
  - Specify group scheduling of multiple UEs for UL transmission to allow multiple UEs to transmit the same TB at least on the same resources.

Note: UE pairing, authentication and establishment/termination of UE collaboration can leave to implementation as done in Rel-18.

Topic-2: Views on Network Controlled-repeaters

In RAN#101, the following scope is identified according to the views from 17 companies [RP-232627]:

Which topics/enhancements are considered critical to be part of the objective of WI (if strong support for NCR). From moderator's point of view the following potential enhancements can be considered, however, further downscoping maybe necessary given limited TU availability in RAN2, RAN1, and RAN3:

- *Specify signalling of side control information to assist NCR setting its amplification gain and/or output power in DL/UL [RAN1, RAN2]*
- *Specify signalling and procedures where NCR-MT controlling an NCR-Fwd in a different carrier, band, and/or frequency range [RAN2, RAN1]*

- Priority of the objectives:

❖ **Out-of-band control**:

- As mentioned in [RP-232155], given the various options for network deployment, especially the combination among different frequencies, e.g., FR1 low band + mid-band, FR1+FR2, additional enhancement to support the out-of-band control seems **more critical to satisfy the needs from the field**.
- Regarding the detailed enhancement, on top of existing signaling structure (e.g., configuration of Fwd-resource), limited enhancements with consideration on "difference & flexibility" for the scheduling over frequency are sufficient.
- Additionally, the framework of signaling can be scaled to support the multiple- beam indication over same frequency without additional efforts.

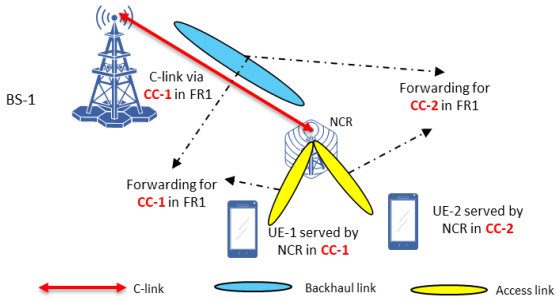


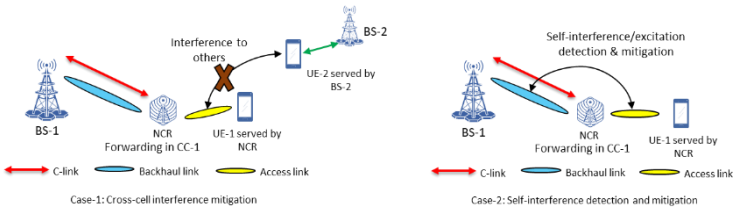
Illustration of Out-of-band control with multi-carrier in same frequency range

Topic-2: Views on Network Controlled-repeaters

- Priority of the objectives:

❖ **Power control:** In general, two aspects are proposed in [RP-232155], i.e., DL power control of access link, UL power sharing between C-link and backhaul link

- **For the UL power sharing**: As discussed in the maintenance phase of Rel-18, without explicit RAN4 requirement for the combined case (e.g., for shared RF), the view is controversial among companies regarding the necessity of enhancement along with solutions. Then, **this aspect can be deprioritized** until additional requirement/regulation is defined.
- **For the DL power control**: In the SI phase of Rel-18 NCR, the benefits of power control, e.g., in semi-static way, have been identified by companies to mitigate the cross cell interference. Additionally, as typical issue for repeater deployment, the **self-excitation issue** should also be addressed to improve the performance. Then, the joint consideration on **this aspect can be prioritized**.



DL PC with two typical usages

❖ **Mobility of NCR:** As mentioned [RP-232627], the support of the mobility is also preferred by companies to extend the usage of NCR, e.g., vehicle mounted NCR or NCR for NTN (i.e., to enable the ground gNB based beam control for satellite with limited on-board processing capability).

- **Mobility of NCR-MT:** For this aspect, since the NCR-MT is assumed as the legacy UE, all mobility related mechanism can be **directly reused by the NCR-MT without additional efforts** once the feature groups are declared to be supported by NCR-MT.
- **Additional impacts on NCR-Fwd:** For the behavior of A-F behavior, the impacts mainly focus on the updates of the SCI along with the mobility behavior of NCR-MT, **limited effort is sufficient to clarify it**. **So, this aspect can be considered and discussed in RAN2-only**.

Topic-2: Views on Network Controlled-repeaters - Objectives

Based on the analysis, the following set of objectives can be considered:

Objectives

- *Specify signalling and procedures where NCR-MT controlling an NCR-Fwd in a different carrier, band, and/or frequency range [RAN2, RAN1]*
- *Specify signalling and procedures to support the A-F behaviour of NCR-Fwd when the mobility is supported for NCR-MT [RAN2]*
- *(As the 2nd priority with check point): Specify signalling and procedures to support the DL power control of access link of NCR-Fwd [RAN1, RAN2]*
    - *Note: Mitigation of the self-excitation can be considered.*